Original Article

Enoxaparin dosing errors in the emergency department

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BACKGROUND: The study aimed to determine the frequency of enoxaparin dosing errors for patients who had a measured emergency department (ED) weight compared to those who did not have a measured ED weight, and to determine if demographic variables (e.g., weight, height, age, English-speaking, race) impact the likelihood of receiving an inappropriate dose.

METHODS: This is a retrospective, electronic chart review of patients who received a dose of enoxaparin in the ED between January 1, 2008 and July 1, 2013. We identified all patients >18 years who received a dose of enoxaparin while in the ED, were admitted, and had at least one inpatient weight within the first four days of hospitalization. Patients were excluded if they received enoxaparin for prophylaxis or a dose of more than 1.25 mg/kg.

RESULTS: A total of 1,944 patients were included. Patients were more likely to experience an error if they did not have a measured ED weight. Over-doses of >10 mg were more likely to occur in patients without a measured ED weight. Patients with no documented ED weight or with a staff-estimated ED weight were more likely to experience a dosing error than those with a patient-stated weight. Patients were more likely to experience an error if their first inpatient weight was more than 96 kg, they were more than 175-cm tall, or were English speaking.

CONCLUSION: Dosing errors are more likely to occur when patients are not weighed in the ED. Modifications to current workflows to incorporate weighing those patients who receive weight-dosed medications may be warranted.

KEY WORDS: Enoxaparin; Weight-based dosing; Emergency department; Dosing errors

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INTRODUCTION

The American Heart Association (AHA), in their Scientific Statement on Medication Errors in Acute Cardiovascular and Stroke Patients, recommends that an accurate weight be obtained on admission.^[1] Accurate patient weights are a vital piece of patient-specific information needed in the emergency department (ED) to assure appropriate dosing for many medications.^[2] However, in daily practice, where clinicians have to obtain body weight urgently, logistical and workflow issues do not always make this practical. Delays in ordering weight-based medications such as induction agents and paralytics used to facilitate intubation, could lead to poor outcomes. This inability to obtain accurate patient weights leads to medication dosages being prescribed based on stated weights or ED

staff estimations of patient weights. Several studies have shown that many patients are able to give accurate estimations of their own weight and weight estimations by family members commonly come within 3% to 5% of the measured weight. Weight estimations by ED staff, however, are often inaccurate and these errors are more pronounced in patients who are underweight or obese.^[1–7] Because many medications are dosed based on actual (and not ideal) body weight, overestimation and underestimation of body weight constitute an important source of medication errors that result in adverse medication events and ineffectiveness, respectively.

Greenwalt et al^[8] published a successful multi-modal strategy used to reduce the number of avoidable, weight-based dosing medication errors which occurred due to

inaccurate, documented, estimated patient weights in the ED. Interventions were aimed at increasing actual weights obtained at triage, implementing processes for effective service and preventive maintenance schedules for stretcher scales, increasing communication to staff about the impact of inaccurate estimated weights, and removing the estimated weight field from the ED electronic forms. No other literature has been published on this topic.

The purpose of this study is to examine the frequency of enoxaparin dosing errors and to determine if certain demographic variables increase the risk of error. The results will either justify the current practice regarding obtaining patient weights or conversely, will highlight the potential for significant medication errors associated with this practice. The latter may help make the case to weigh specific, high-risk patients who receive medications that are dosed by weight.

METHODS

Study design

This is a retrospective, electronic chart review of patients who received a dose of enoxaparin in the ED between January 1, 2008 and July 1, 2013. This study was reviewed and determined to be exempt from full review by the institutional review board at our institution.

Study setting and population

The research study was conducted at a single academic hospital with an annual ED census of 110,000 patients and an admission rate of 22%. We identified all patients >18 years old who received a dose of enoxaparin while in the ED, were admitted, and had at least one measured inpatient weight within the first four days of hospitalization. One mg/kg is the most common dose of enoxaparin prescribed in this ED; with 1.5 mg/kg rarely being prescribed for inpatient deep vein thrombosis (DVT) treatment. At the time of prescribing, most prescribers do not know if a patient being treated for DVT will be discharged home from the ED or admitted to the Medical Center, and hence, will commonly prescribe a dose of 1 mg/kg. Patients were excluded if they received enoxaparin for prophylaxis or a dose of more than 1.25 mg/kg while in the ED. This dose was chosen as a cutoff for exclusion because it would have been extremely difficult to determine if these were overdoses for the patients who received 1 mg/kg or if the prescriber intended to prescribe 1.5 mg/kg and the dose was a result of rounding.

Study protocol

Queries were written against the ED electronic health record, EMStat (Allscripts, Chicago, IL) in order to identify all adult patients who received at least one dose of enoxaparin and to extract information on ED weights documented by the ED nursing staff (weight, measurement unit, and whether the weight was measured, estimated or stated). A second query was written against the inpatient electronic health record, General Electric Centricity Enterprise Software System (General Electric, Fairfield, CT) to identify all patients who had a weight documented within four days of admission. The files were merged and cases matched according to medical record number. One hundred and nine cases were excluded because of the absence of an inpatient weight. The queries were validated against the electronic health records to ensure the accuracy of the data. This native data set was then reviewed for cases in which enoxaparin 30 mg or 40 mg were administered. A manual chart review was performed for each of these cases and those in which the dose was administered for prophylaxis were excluded from the final data set. For all patients included in the final data set, the dose of enoxaparin administered in the ED was divided by the first inpatient weight to determine the mg/kg dose. Cases in which the patient received a dose of more than 1.25 mg/kg were excluded.

Measurements of key outcome measures

The primary objective of this study was to measure the frequency of enoxaparin dosing errors for patients who had a measured ED weight compared to those who did not. The hospital policy specifies rounding the dose to the closest 5 mg. A dose was classified as an error or inappropriate if it was more than 5 mg from the weight-appropriate dose in either direction. The secondary objectives were to determine whether the means of assessing weight and certain demographic variables (e.g., weight, height, age, English-speaking, race) impacted on whether an error occurred and the likelihood of receiving an inappropriate dose defined as at least a 5 mg, 10 mg, or 15 mg under-dose or over-dose.

Data analysis

Descriptive statistics and χ^2 were used to analyze the primary and secondary outcomes. Quartiles were determined for demographic variables including weight, height and age. Levene's robust test for equality of variances was used to compare variation in the different weight categories. A *P*-value of less than 0.05 was considered statistically significant. Stata, version 13.1

(StataCorp LP, College Station, Texas), was used for all analyses.

RESULTS

A total of 2,295 patients received a dose of enoxaparin while in the ED from January 1, 2008 to July 1, 2013. Totally 2,186 of these patients had an inpatient weight recorded within 4 days of admission. Fifty patients had received either 30 mg or 40 mg of enoxaparin while in the ED. Twenty-six of these cases were excluded from the analysis; seven patients were receiving enoxaparin at home and it was continued

while in the ED, five patients had cancer and received enoxaparin as per the hematologist/oncologist for prophylaxis and fourteen had a fracture/total knee replacement and received enoxaparin for prophylaxis. Of the remaining patients, 216 received a dose >1.25 mg/kg and were excluded. 1,944 patients were included in the final data set.

Primary objective

Figure 1 shows the distribution of enoxaparin dosing (mg per kg). Patients without a documented ED weight had greater dosing variation (as measured by interquartile range or standard deviation, $P<0.0001$). Figure 2 shows dosing errors for patients with and without a measured ED weight. Patients without a measured ED weight were randomly sampled to select 163 patients, the number of patients with a measured ED weight. For patient weights of greater than 100 kg, providers commonly selected a lower than appropriate dose (most commonly 100 mg). For patients below 100 kg, the number of dosing errors and their magnitude were less amongst patients with a measured ED weight.

Patients were more likely to experience an enoxaparin dosing error if they did not have a measured ED weight (42.2% [751/1781] of patients without a measured ED weight vs. 24.5% [40/123] of patients with a measured ED weight, $P<0.001$). Four patients had an ED weight recorded in kg that was close to the patient's true weight in pounds, and 1 patient had an ED weight recorded as pounds that was numerically close to their weight in kg.

Secondary objectives

Patients were more likely to experience an

Figure 1. ED enoxaparin doses (in mg/kg, using the first inpatient weight). Patients were stratified into two groups, depending upon whether a measured weight was documented in the ED record. The shaded areas represent the 25th to 75th percentiles of doses for each weight category, and the diamonds reflect the 10th and 90th percentile doses. The width of the distributions (as measured by Levene's robust test statistic for the equality of variances) varies significantly between the two groups ($P<0.0001$).

Figure 2. Accuracy of enoxaparin dosing for patients with and without a measured ED weight. For patients above 100 kg, providers commonly ordered inappropriately low doses (most commonly 100 mg). Patients with a measured ED weight had fewer dosing errors and the errors were smaller. Each of these weight categories was randomly sampled to select 163 patients, the number of patients with a measured ED weight.

enoxaparin dosing error if their first inpatient weight was more than 96 kg, they were more than 175-cm tall, or were English speaking as seen in Table 1. Not having a measured ED weight, having a heavier weight, a taller stature, and English language spoken were all associated with a greater likelihood of receiving a 5 mg, 10 mg and 15 mg under-dose of enoxaparin as seen in Table 2. As seen in Table 3, patients without a measured ED weight were more likely to receive an over-dose of enoxaparin of at least 5 mg (190/1,781 [11.6%] vs. 5/163 [3.1%], $P=0.002$) and 10 mg (67/1,781 [3.7%] vs. 0/163 [0%], $P=0.012$). The lower a patient's actual body weight, the more likely they were to receive overdose of enoxaparin of at least 5 mg ($P=0.001$) and 10 mg ($P=0.018$). Older patients were more likely to receive over-doses of at least 5 mg ($P=0.001$) and 10 mg ($P=0.005$). Asian patients were more likely to receive an over-dose of enoxaparin of at least 10 mg ($P=0.001$), while Black/African American patients were more likely to receive over-doses of at least 15 mg ($P=0.001$).

Amongst patients without a measured ED weight, those with a stated weight were less likely to receive over-doses of enoxaparin of at least 5 mg patients (46/569 [8%] vs. 144/1,212 [12%], respectively, $P=0.05$), whereas rates were similar for over-doses of at least 10 and 15 mg. In patients less than 100 kg without a measured ED weight, those with a stated weight were less likely to experience under-doses of 5 mg, 10 mg and 15 mg (5 mg under-dose: 223/930 [24%] without a measured weight vs. 57/435 [13%] for stated weight;

10 mg under-dose: 112/930 [12%] without a measured weight vs. 19/435 [4%] for stated weight; 15 mg under-dose: 61/930 [7%] without a measured weight vs. 8/435 [2%] for stated weight; $P<0.001$ for each under-dose comparison).

DISCUSSION

While it may seem self-evident that absence of a measured and documented weight would lead to errors in dosing of weight-based medications, our study shows that this is indeed so to a surprising degree. In our large cohort of patients receiving treatment doses of enoxaparin in the ED, almost 50% of patients experienced an enoxaparin dosing error when the weight was not obtained and documented in the ED.

In the Thrombolysis in Myocardial Infarction (TIMI) 11A trial, patients received a 30 mg IV bolus of enoxaparin followed by either 1 mg/kg or 1.25 mg/kg subcutaneously.^[9] The major hemorrhage rate was 1.9% with the lower dose and 6.5% with the higher dose. Therefore, the rate of major bleeding increased to more than 3-fold with an increase in enoxaparin dose of 0.25 mg/kg (25%) above the 1 mg/kg standard dose. The 14-day incidence of death, recurrent myocardial infarction, or myocardial ischemia requiring revascularization was 5.2% in the group that received 1 mg/kg and 5.6% in the group that received 1.25 mg/kg. In the TIMI 11A study the lower dose (1 mg/kg) was associated with a lower risk of hemorrhage with efficacy equivalent to that of the higher dose (1.25 mg/kg).

The extent to which bleeding risk is attributable to excess dosing of enoxaparin was further investigated in a study which used data from the Can Rapid Risk Stratification of Unstable Angina Patients Suppress Adverse Outcomes With Early Implementation of the ACC/AHA Guidelines (CRUSADE) National Quality Improvement Initiative.^[10] Two thousand and two patients (18.7%) received an excess dose of enoxaparin (the administered daily dose exceeded the recommended daily dose (2 mg/kg for patients with a creatinine clearance of 30 mL/min or greater and 1 mg/kg for patients with a creatinine clearance less than 30 mL/minute), 3,116 (29.2%) received a lower-than-recommended dose (administered daily dose was more than 10 mg below the recommended daily dose), and 5,569 (52.1%) received the recommended dose. The proportion of patients with major bleeding was significantly higher in patients who received an excess enoxaparin dose than in those who received the recommended dose (14.2%

Table 1. Variable associated with inappropriately dosing enoxaparin in the ED

Variables	Inappropriate dose n/N (%)	P
First inpatient weight		0.001
<65 kg	108/439 (25)	
65–79 kg	143/494 (29)	
79.1–96 kg	205/501 (41)	
>96 kg	335/510 (66)	
Height		0.001
<160 cm	170/514 (33)	
160–167 cm	161/422 (38)	
167.1–175 cm	143/370 (39)	
>175 cm	211/416 (51)	
Age		0.115
<47 years	202/486 (42)	
47–59 years	217/486 (45)	
59.1–73 years	190/486 (39)	
>73 years	182/486 (37)	
Language spoken		0.001
English	593/1,365 (43)	
Other	198/579 (34.2)	
Race		0.461
White	111/282 (39)	
Black/African American	99/212 (47)	
Asian	8/25 (32)	
American Indian/Alaskan Native	11/25 (44)	
Hawaiian/Pacific Islander	3/7 (43)	
Unable to obtain	82/213 (38)	

Table 2. Variables associated with under-dosing enoxaparin in the ED

Variables	Under-dosed by at least 5 mg, n/N (%)	P-value	Under-dosed by at least 10 mg, n/N (%)	P-value	Under-dosed by at least 15 mg, n/N (%)	P-value
ED weight		0.001		0.001		0.001
Measured	34/163 (20)		21/163 (13)		18/163 (11)	
Not measured	561/1,781 (31)		353/1,781 (20)		236/1,781 (13)	
First inpatient weight		0.001		0.001		0.001
<65 kg	37/439 (8)		13/439 (3)		4/439 (1)	
65–79 kg	83/494 (17)		30/494 (6)		14/494 (3)	
79.1–96 kg	157/501 (31)		81/501 (16)		42/501 (8)	
>96 kg	318/510 (62)		250/510 (49)		194/510 (38)	
Height		0.001		0.001		0.001
<160 cm	111/514 (22)		68/514 (13)		45/514 (9)	
160–167 cm	116/422 (27)		70/422 (17)		39/422 (9)	
167.1–175 cm	108/370 (29)		66/370 (18)		46/370 (12)	
>175 cm	178/416 (43)		119/416 (29)		98/416 (24)	
Age		0.001		0.001		0.001
<47 years	173/486 (36)		117/486 (24)		87/486 (18)	
47–59 years	174/486 (36)		118/486 (24)		83/486 (17)	
59.1–73 years	139/486 (29)		84/486 (17)		58/486 (12)	
>73 years	109/486 (22)		55/486 (11)		26/486 (5)	
Language spoken		0.001		0.001		0.001
English	459/1,365 (34)		297/1,365 (22)		206/1,365 (15)	
Other	136/579 (23.5)		77/579 (13.3)		48/579 (8.3)	
Race		0.39		0.123		0.172
White	91/282 (32)		54/282 (19)		39/282 (14)	
Black/AA	68/212 (32)		46/212 (22)		32/212 (15)	
Asian	3/25 (12)		0/25 (0)		0/25 (0)	
AI/AN	9/25 (36)		7/25 (28)		6/25 (24)	
Hawaiian/PI	2/7 (29)		1/7 (14)		1/7 (4)	
Unable to obtain	62/213 (29)		37/213 (17)		24/213 (11)	

mg: milligrams; ED: emergency department; kg: kilograms; cm: centimeters; AA: African American; AI: American Indian; AN: Alaskan Native; PA: Pacific Islander.

Table 3. Variables associated with over-dosing enoxaparin in the ED

Variables	Over-dosed by at least 5 mg, n/N (%)	P-value	Over-dosed by at least 10 mg, n/N (%)	P-value	Over-dosed by at least 15 mg, n/N (%)	P-value
ED weight		0.002		0.012		0.293
Measured	5/163 (3.1)		0/163 (0)		0/163 (0)	
Not measured	190/1,781 (11.6)		67/1,781 (3.7)		12/1,781 (0.7)	
First inpatient weight		0.001		0.018		0.005
<65 kg	71/439 (16)		23/439 (5)		1/439 (0.2)	
65–79 kg	60/494 (12)		20/494 (4)		0/494 (0)	
79.1–96 kg	48/501 (10)		17/501 (3)		9/501 (2)	
>96 kg	17/510 (3)		8/510 (2)		5/510 (1)	
Height		0.314		0.287		0.524
<160 cm	59/514 (11)		21/514 (4)		3/514 (1)	
160–167 cm	45/422 (11)		16/422 (4)		3/422 (1)	
167.1–175 cm	35/370 (9)		12/370 (3)		3/422 (1)	
>175 cm	33/416 (8)		8/416 (2)		1/416 (0.2)	
Age		0.001		0.005		0.330
<47 years	29/486 (6)		8/486 (2)		2/486 (0.4)	
47–59 years	43/486 (9)		18/486 (4)		6/486 (1.2)	
59.1–73 years	51/486 (10)		14/486 (3)		2/486 (0.4)	
>73 years	73/486 (15)		28/486 (6)		5/486 (1)	
Language spoken		0.551		0.156		0.049
English	134/1,365 (10)		53/1,365 (4)		14/1,365 (1)	
Other	62/579 (10.7)		15/579 (2.6)		1/579 (0.2)	
Race		0.065		0.001		0.001
White	20/282 (7)		7/282 (3)		1/282 (0.4)	
Black/AA	31/212 (15)		17/212 (8)		9/212 (4)	
Asian	5/25 (20)		3/25 (12)		0/25 (0)	
AI/AN	2/25 (8)		1/25 (4)		0/25 (0)	
Hawaiian/PI	1/7 (14)		0/7 (0)		0/7 (0)	
Unable to obtain	20/213 (9)		2/213 (1)		0/213 (0)	

mg: milligrams; ED: emergency department; kg: kilograms; cm: centimeters; AA: African American; AI: American Indian; AN: Alaskan Native; PA: Pacific Islander.

vs. 7.3%; $P < 0.001$). Among patients who received an excess dose, 1,282 (64%) received a high excess dose (administered daily dose that was more than 30 mg above the recommended daily dose). Use of a high excess dose was significantly associated with a higher risk of major bleeding compared with those receiving the recommended dose ($OR = 1.53$; 95% $CI = 1.24-1.89$). Major bleeding also occurred more often in those who received an excess dose between 10 and 30 mg above the recommended daily dose, but this did not achieve statistical significance ($OR = 1.21$; 95% $CI = 0.85-1.70$). There was no significant difference in the proportion with major bleeding among those who received a lower-than-recommended dose compared with those who received the recommended dose (7.9% vs. 7.3%; $P = 0.50$). The CRUSADE study focuses on dosing errors associated with total daily doses. This differs from the current study which focuses on patients where the ED clinicians' intention was to prescribe a 1 mg/kg single dose which would be dosed either daily or every twelve hours based on renal function once they were admitted. Patients who were dosed using other dosing strategies such as 1.5 mg/kg per day were excluded.

Prescribers in this study ordered doses of enoxaparin ranging from 0.01–3.14 mg/kg based on their documented ED weights. The electronic medical record for each patient who had an extreme dose of enoxaparin ordered was reviewed. The lower extreme of this range reflects erroneous orders which were identified and modified prior to being administered. The extremes in dosing could be attributed to the cases where there were documentation errors involving units when recording the ED weight. After correcting for the unit errors, these patients received an average of 1.05 mg/kg of enoxaparin. This problem is not unique to our ED. The Pennsylvania Patient Safety Authority reported a 2009 analysis of 470 medication errors involving wrong weights where over 25% were due to confusion between pounds and kilograms.^[11] The Emergency Nurses Association holds the position that pediatric weights should only be measured and documented in kilograms, scales used to weigh pediatric patients should only be configured to record weight in kilograms and electronic medical records should be standardized to only allow kilograms for pediatric weight entries.^[12] Perhaps, the same position should be expanded to the adult population.

The scope of our study was limited to identifying enoxaparin dosing errors in the ED. The study was designed to identify errors that were made when ordering enoxaparin and do not necessarily translate into

administration errors. We did not follow patients to see if under-dosage or over-dosage was associated with clinical outcomes such as higher rates of embolization or excess bleeding. Other clinical trials have demonstrated the perils of inaccurate dosing. In a study of only 25 patients, Dos Reis Mercado et al were able to demonstrate that underestimation of weight in the ED was significantly associated with under-dosing of enoxaparin and inadequate anticoagulation, as measured by anti-Factor Xa activity.^[13] The aforementioned CRUSADE and TIMI-11A trials both demonstrated the association of over-dosing of enoxaparin with excess bleeding.^[9,10]

Our study results were in accord with other trials in that stated weights (by the patient or caregiver) were more accurate than weights estimated by ED staff.^[1-7] Our data also reveal some interesting detail about the factors associated with weight estimation inaccuracies. Our data show that heavier, taller, or English speaking patients are more likely to be under-dosed, and that patients with a lower actual body weight and older patients are more likely to receive an over-dose.

Another result of our study that warrants comment is that 25% of patients with a measured weight in the ED still received an inaccurate dose. There are several possible sources of this error. Enoxaparin is available for subcutaneous administration as pre-filled syringes in concentrations of 30 mg/0.3 mL and 40 mg/0.4 mL, graduated pre-filled syringes in concentrations of 60 mg/0.6 mL, 80 mg/0.8 mL, 100 mg/1 mL, 120 mg/0.8 mL and 150 mg/1 mL. Therefore, (1) The prescribing physician may have rounded the dose to the nearest commercially available dose despite knowing the weight. (2) The prescribing physician may have not known the correct dosing. (3) The prescribing physician may have altered the standard dosing based on the perceived likelihood of thrombosis or bleeding risk. (4) The ED weight may have been different from the inpatient weight. (5) The prescribing physician may not have been the same physician who documented the ED weight or may not have been aware of the documented weight. (6) The prescribing physician or nursing staff administering the enoxaparin may not have felt comfortable administering a larger dose which may have resulted in underdosing. In patients who had received less than 1 mg/kg based on the documented ED weight, approximately 20% of the doses were either 95 mg or 100 mg. We did not distinguish among the above possibilities, though with such a large percentage, this source of error certainly requires further investigation.

The issue of using a measured weight to calculate

a dose of a weight-based medication that is to be administered in the ED can be expanded far beyond enoxaparin. McGillicuddy et al^[14] evaluated the accuracy of dosing succinylcholine and etomidate in an urban Level 1 trauma center. Over a one year study period, 128 patients were intubated with succinylcholine. Using a range of 1–1.5 mg/kg, only 30% ($CI=22-38$) of patients received a dose in the correct range. Etomidate was given in 126 of 129 intubations. Fifty-seven percent ($CI=48-66$) of patients were given a dose of etomidate within the correct range of 0.2–0.3 mg/kg. The authors attribute the greater variation in succinylcholine dosing to weight estimation. A study by Naguib et al^[15] has shown that underdosing of succinylcholine can make adequate airway visualization and intubations more difficult.

Breuer et al^[16] conducted a study to evaluate availability of body weight information, accuracy of estimations, and final dosing of alteplase in a routine clinical setting. One hundred and nine patients were included in the study. Of these, estimation errors ranged from 20.8% (patient's own estimations) up to 38.2% (treating physician) and 42.2% (emergency nurse). Twenty-nine patients received an alteplase dose diverging > 10% from the optimal dose. Twelve were under, and 17 overdosed. Although overdosing did not increase the risk for symptomatic intracerebral hemorrhages, underdosing was a strong predictor for worse clinical outcomes.

In addition to the clinical rationale for improving timely access to accurate patient weights, there are policy and regulatory issues. The 1990 Americans with Disabilities Act requires equal access to care for patients with disabilities, but patients with disabilities are commonly not able to access standard care.^[17,18] The 2010 Patient Protection and Affordable Care Act required the creation of standards for accessible medical equipment for adults.^[19] The law requires us to provide equal access for persons with disabilities, but many EDs do not currently have the ability to rapidly weigh a non-ambulatory adult patient.

Our study has some limitations. It was conducted at one site and the results may have been influenced by local aspects such as location, hospital policy, patient demographics, and staff experience. There was also no policy within our ED to govern dosing of enoxaparin in obese patients which may lead to greater variability. The electronic medical record (EMR) had no forcing function regarding weight and only allowed dosing in total mg (vs. mg/kg). Our EMR allowed multiple weights to be entered and these weights can be entered by different individuals caring for the patient. This can

lead to discrepancies in determining which weight was used to dose the medication. The electronic health record permitted the weight to be entered in either pounds or kilograms, introducing another source of error. It also lacks the capability to support weight-based dosing, leaving calculations and dose determination to the provider without providing any guidance. Lastly, we used the first inpatient weight as the “gold standard”. Although unlikely, errors in documentation of this weight may have occurred.

CONCLUSIONS

Obtaining an accurate weight may complicate workflow in the ED and would likely require specialized equipment for incapacitated patients. But certainly we can do better in this regard. Although our study does not prove that we are harming people by failing to weigh and document, it underlines the fact that we have good reason to worry about this source of error and that the added effort needed to obtain accurate weights in the ED is likely to be worth it.

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Contributors: SJC proposed the study and wrote the first draft. All authors read and approved the final version of the paper.

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